



NATIONAL ECONOMIC IMPACTS

from Department of Defense CRADAs
Pilot Study, 2019

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National Economic Impacts from Department of Defense CRADAs Pilot Study, 2019

EXECUTIVE SUMMARY

This 2019 pilot study evaluates the economic outcomes and impacts of Department of Defense (DoD) cooperative research and development agreements (CRADAs). The purpose was to quantify the extent to which DoD CRADAs are contributing to new economic activity and job creation in the United States and also to the transition of new technology to U.S. military use.

The study focuses on CRADAs established between 1996 and 2018 by three representative DoD labs: the U.S. Army Combat Capabilities Development Command Aviation & Missile Center, the Naval Surface Warfare Center Crane Division, and the Air Force Research Laboratory 711th Human Performance Wing.

The research team surveyed all 413 companies and other organizations having CRADAs with the three DoD labs established during the 1996-2018 period. Companies were asked to divulge the total sales of new products and services and other economic outcomes directly related to the technologies that they developed under their DoD CRADAs. They also were asked about related economic outcomes, including sales to the U.S. military, follow-on research and development contracts, licensing revenue, and sales by licensees and spin-out companies.

The response rate was very high—97 percent of the companies and other non-DoD entities with DoD CRADAs participated in the study. The team was able to obtain full or partial information on the economic outcomes of 628 out of the 645 total CRADAs. IMPLAN economic impact assessment software was used to estimate the economic impacts related to the sales and other economic outcomes from these CRADAs.

Study results are believed to significantly understate the actual economic impacts because of non-responding companies, the effects of inflation, and other factors analyzed in the report.

Major findings from the study included the following:

- **\$8.7 billion in total sales** of new products and services resulting from the DoD CRADAs
- **\$4.9 billion** in sales of new products to the U.S. military
- **Over \$23 billion in total economic impact** nationwide
- **Nearly \$3 billion** in new tax revenues (federal, state, and local)
- **118,929 jobs** (6,607 per year) with average compensation of \$75,292



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PURPOSE OF STUDY

This study quantifies the national economic impacts from a small sample of cooperative research and development agreements (CRADAs) established between the Department of Defense (DoD) and various non-DoD organizations, primarily private-sector companies and universities. It was intended as a pilot project, and its purpose was to evaluate the extent to which DoD CRADAs are resulting in new products and services that benefit the national economy and U.S. defense mission.

The study focuses on the CRADAs of three representative DoD labs—one each from the Army, Navy, and Air Force. These three labs are the U.S. Army Combat Capabilities Development Command Aviation & Missile Center (CCDC Aviation & Missile Center, formerly known as AMRDEC), the Naval Surface Warfare Center Crane Division (NSWC Crane), and the Air Force Research Laboratory 711th Human Performance Wing (711 HPW). Together, these three labs initiated over 640 CRADAs between 1996 and 2018. This represents approximately five percent of the total CRADAs established by DoD during this period.

Researchers first conducted a survey of all non-DoD CRADA partners, to determine the total sales of new commercialized products and services resulting from these CRADAs. Analysts then used IMPLAN economic impact assessment software to estimate the resulting economic impacts. These included economic output, value added, employment, labor income, and tax revenues generated by the total sales.

CRADA OVERVIEW

The Federal Technology Transfer Act of 1986 (PL99-502) establishing CRADAs gave federal laboratories the authority to enter into research and development (R&D) collaborations with public, private, and nonprofit organizations. Congress's intent was to promote the development of new technologies and their transfer to the marketplace to help ensure national technological competitiveness. CRADAs are a unique contractual vehicle and are distinctively different from a procurement contract, grant, or cooperative agreement.

CRADAs provide many benefits to both DoD and the collaborating non-federal entities. They enable the CRADA partners to leverage each other's resources and capabilities in order to accelerate new technology development and defray their R&D costs. They also allow companies to have new technology evaluated by DoD and receive feedback on desired improvements for DoD applications. Highly importantly, CRADAs provide a protected environment in which the CRADA partners can share ideas, information,



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expertise, and technology. Information is protected from the Freedom of Information Act (FOIA) for up to five years. CRADAs also protect each partner's existing inventions or intellectual property (IP), and provide an equitable mechanism for protecting and sharing new inventions.

IP already belonging to DoD or the collaborator prior to the CRADA initiation date continues to belong exclusively to the existing owner. Collaborator inventions under the CRADA belong exclusively to the collaborator—although the government retains non-exclusive rights to these inventions for government use. The collaborator gets a non-exclusive, paid-up license to all DoD inventions under the CRADA and can request an exclusive license, which will ordinarily be granted on reasonable terms. DoD and the collaborator jointly own new joint inventions; however, DoD may license its share to the collaborator for reasonable compensation. The opportunity to acquire new IP through participation in a CRADA is intended to be attractive to industry, as a way to encourage R&D collaborations with DoD.

Overall, CRADAs have helped DoD reduce the cost of new technology development and acquisition. In addition, they have infused the DoD lab system with innovation and specialized expertise from the private sector, and also significantly expanded the defense industrial base to include many highly innovative small companies that are not traditional defense contractors. Finally, as this study shows, DoD CRADAs have contributed significantly to the defense mission and have had a substantial impact on the national economy.

RESEARCH TEAM

This economic impact study was conducted by TechLink in collaboration with the Business Research Division (BRD) of the Leeds School of Business at the University of Colorado Boulder. TechLink is a federally funded technology transfer center located at Montana State University. Since 1999, it has served as DoD's primary national partnership intermediary, helping to develop licensing agreements, CRADAs, and other partnership agreements between DoD labs and U.S. industry nationwide.¹ Conducting economic impact studies has been one of its important related activities. TechLink has previously conducted over a dozen national economic impact studies of DoD technology transfer and Small Business Innovation Research programs. The BRD has been analyzing local, state, and national economies for more than 100 years and specializes in economic impact studies and customized research projects that help companies, associations, nonprofits, and government agencies make informed business and policy decisions.²

¹ For more information, see www.techlinkcenter.org

² For more information, see www.colorado.edu/leeds/centers/business-research-division



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The principal authors of the study were Dr. Michael Wallner, Jeff Peterson, and Dr. Will Swearingen of TechLink, and Brian Lewandowski of the BRD. Other members of the team included Matt Rognlie, Joe Hutton, and Jessica Kaplin of TechLink, and Dr. Richard Wobbekind of BRD.

METHODOLOGY

This study was undertaken in **three major phases**:

1. **Data Gathering.** During the data gathering phase, the research team contacted the non-DoD organizations (subsequently referred to as “companies”³) engaged in CRADAs with the three DoD labs included in the study. Companies were asked to divulge the total sales of new products and services and other economic results directly resulting from new technologies developed under these CRADAs. This phase lasted for six months and ran from February through July 2019.
2. **Data Analysis.** During this phase, the evaluation team analyzed the information gathered during the first phase and used IMPLAN economic impact assessment software to estimate the economic multipliers and total economic impacts resulting from the sales of new products and services derived from the CRADAs. This second phase was accomplished in July and August 2019.
3. **Final Report.** Also, in July and August 2019, the authors prepared the final report, drawing on the results from the previous two phases. Research processes conducted during the first two phases are described in the following sections.

Data Gathering

In February 2019, TechLink initiated this pilot study of the economic outcomes and impacts resulting from CRADAs established by the CCDC Aviation & Missile Center, NSWC Crane, and the 711 HPW. To enable the study, these DoD labs provided essential CRADA information on a total of 645 CRADAs: 237 from the CCDC Aviation & Missile Center, 207 from NSWC Crane, and 201 from the 711 HPW. While all three labs included CRADAs initiated as late as 2018, execution dates of the earliest CRADAs varied somewhat by lab: 1996 for the CCDC Aviation & Missile Center; 2000 for the 711 HPW; and 2003 for the NSWC Crane.

³ Use of the term “companies” is not only a convenient way to abbreviate the text; it also is appropriate because when the CRADA partners were universities, they typically transferred promising new CRADA-related inventions to the private sector for commercialization.



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Upon receipt of the essential CRADA information from the labs, three TechLink economic research specialists surveyed all 413 companies partnered with DoD in these CRADAs. Companies were asked a series of questions that focused on the economic outcomes related to their CRADAs. They were informed that their responses would be treated as confidential information and aggregated with those of other companies. Identifying information was removed before submission to the DoD to anonymize responses. Questions asked included the following:

1. Did the CRADA lead to the sale of any new products or services? If so, what were the total cumulative sales of these new products or services?⁴
2. What was the dollar value of these sales to the U.S. military, either directly or through a prime contractor?
3. Did the CRADA project lead to any follow-on R&D contracts for further development of the CRADA-developed technology? If so, what was the dollar value of those contracts?⁵
4. Did you license the CRADA-developed technology to another company? If so, what were the total royalties received from the licensee(s)? What were the total sales by the licensee(s) of the technology licensed?
5. Did you create a spin-out company to commercialize the CRADA-developed technology? If so, what were the total sales by the spin-out company?
6. Did you receive any subsequent outside investment funding, such as venture capital or angel funding, directly related to the CRADA-developed technology? If so, what was the dollar amount of the investment?
7. Was your company acquired as a direct result of the CRADA-subject technology that you were developing or commercializing?
8. What was the size of your company at the time of the agreement? (Very Small, 1-9 employees; Small, 10-99; Medium, 100-499; Large, 500 and larger). If Very Small, were you a start-up company specifically created to enter into the CRADA agreement or to commercialize the technology?

The company response rate was extremely high—97 percent of the companies were successfully contacted and complied with the survey. In all, 402 companies provided

⁴ Companies were not asked whether the CRADA-subject technology that they subsequently commercialized originated with the company, resulted from joint development, or was a DoD invention that was licensed under CRADA rights. TechLink plans to inquire about the source of the technology in future CRADA studies.

⁵ Contracts for further development of the CRADA-developed technology were treated as sales of R&D services and were included in the total sales.



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information, by email and telephone, about the financial outcomes of 628 CRADAs.⁶ Only seven companies (with 12 CRADAs) either openly refused to participate in the study or were non-cooperative. An additional four companies (with five CRADAs) were not contacted despite persistent efforts, possibly because they had ceased to exist as corporate entities. Altogether, the research team was able to obtain definitive information on the financial outcomes of 628 of 645 CRADAs.

For each CRADA with sales results, TechLink assigned an industry-specific 6-digit North American Industry Classification System (NAICS) code. This was an essential step for analysis of the overall economic impacts. NAICS codes are used to assign industry sectors used by the IMPLAN model. As the federal government's standard industry classification system, NAICS codes allow companies to be aggregated according to the specific activities they undertake. NAICS recognizes 1,057 different industries in the United States and assigns a unique code to each.

To identify the appropriate NAICS codes, the research team used multiple sources. These included the U.S. Census Bureau's NAICS code site: <https://www.census.gov/cgi-bin/sssd/naics/naicsrch/>, the federal System for Award Management (www.sam.gov), D&B Hoovers (www.hoovers.com), and the LexisNexis Academic web site (www.lexisnexis.com). Researchers assigned codes based on descriptions of the technologies provided during interviews. During the review process, TechLink's chief data analyst checked each code for accuracy.

TechLink subsequently submitted a final dataset of economic results from its survey to the BRD at the University of Colorado Boulder. The dataset included—for each CRADA leading to sales—a code number to identify the agreement and conceal the company's name, the 6-digit NAICS code for the corresponding product or service, and the total sales figures. The sales category included sales of products and services, follow-on R&D contracts, royalties or sales by licensees, and sales by spin-out companies.

Data Analysis

The BRD employed IMPLAN, a widely used input-output model, to estimate the economic contributions resulting from these CRADA-induced sales figures. More than 1,500 entities in academia, the private sector, and government use IMPLAN to estimate economic impacts. While this study focused on the entire United States, estimates can also be specified by state, county, or ZIP Code (www.implan.com).

⁶ Eighty-eight companies (21 percent) had two or more CRADAs with DoD. Some of the larger prime contractors had numerous CRADAs—up to 32 in one case.



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IMPLAN draws on a mathematical input-output framework originally developed by Wassily Leontief, the 1973 Nobel laureate in economics, to study the flow of money through a regional economy. IMPLAN assumes fixed relationships between producers and their suppliers, based on demand, and that inter-industry relationships within a given region's economy largely determine how that economy responds to change. Increases in demand for a certain product or service causes a multiplier effect—a cascade of ripples through the economy. This increased demand affects the producer of the product, the producer's employees, the producer's suppliers, the suppliers' employees, and others, ultimately generating a total impact on the economy that significantly exceeds the initial change in demand.

For example, a company develops a time domain reflectometer (TDR) to detect faults in aircraft electronics under a CRADA with the 711 HPW. It subsequently manufactures these TDRs and sells them to the Air Force and commercial aviation companies. The company needs to employ factory workers, who spend their earnings on groceries, housing, and other goods. It also must purchase machines, tools, components, and raw materials from other companies, which also employ workers who purchase goods. This ripple of activity extends through the economy.

In this example, *direct effects* are the sales of the new TDR. *Indirect effects* are the result of inter-industry purchases of components and raw materials needed to manufacture the TDR. *Induced effects* are driven by employees spending their wages across a wide spectrum of the economy. *Total economic impacts* are the sum of direct effects, indirect effects, and induced effects.

Multipliers are ratios of the overall economic impacts to the direct effects and are typically derived from the following equation: (direct effect + indirect effect + induced effect) / direct effect. Multipliers are very specific to industry sectors and regions. The IMPLAN model distinguishes between 536 industry sectors which are based on NAICS codes. Each sector has an output multiplier based on a unique pattern of purchases from other industries, both inside and outside of the regional economy. IMPLAN is updated annually using data collected by various federal agencies.

Upon receiving the CRADA sales data from TechLink, the BRD converted each NAICS code to its corresponding IMPLAN sector. With all of the sales figures properly categorized, the model yielded an estimate of the direct, indirect, and induced effects resulting from the CRADAs. The overall purpose of this modeling exercise was to estimate the total economic contribution of these sales to the nation's economy, including total economic output, value added, employment, labor income, and tax revenues.



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The data presented are aggregated through 2019 and expressed in 2019 dollars. Nearly all company sales occurred prior to 2019, with some possibly dating back to the late 1990s. However, the survey did not ask when sales occurred, so the study assumes a constant year. Using 2019 as the reference year represents a conservative approach, ignoring the higher value of earlier sales figures due to inflation (for example, \$100 in 2000 had the same purchasing power as \$147 in 2018.)

RESULTS REPORTED BY COMPANIES

Sales from Agreements

The surveyed companies reported that 168 (26 percent) of the 645 CRADAs included in the study had successfully generated sales of products or services (*see* Table 1). **Total cumulative sales and revenues reported were nearly \$8.7 billion.**⁷ The “total sales” category in Table 1 encompasses not only the companies’ cumulative sales of products and services resulting from the CRADAs, but also follow-on R&D contracts, sales of directly related products by licensees, and sales by spin-out or start-up companies.

Table 1. Sales resulting from CRADAs established by the CCDC Aviation and Missile Center, NSWC Crane, and the 711 HPW, 1996-2018

	Total Companies	Total CRADAs	Percent of CRADAs	Total Sales \$ Millions	U.S. Military Sales \$ Millions
Included in Study	413	645	100%	--	--
Achieving Sales	121	168	26%	\$8,694	\$4,882
No Sales	281	460	71%	--	--
Unknown	11	17	3%	--	--

Source: TechLink survey, February-July 2019

⁷ \$8,693,977,000



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A total of 460 CRADAs (71 percent) did not generate sales. This category included newer agreements involving technologies that companies were actively working to commercialize and agreements that, for many reasons, had not resulted in commercialization. A significant portion of the latter includes CRADAs that were never intended to produce commercial outcomes or that were unlikely to do so. A small number of agreements, 17 (3 percent), involved companies from which the research team was unable to obtain information—either because the involved companies were unwilling to participate (12 agreements) or because they were uncontactable (5 agreements).

Military Sales. The survey found that **sales to the U.S. military amounted to \$4.9 billion**, or 56 percent of the total from all sources (*see* Table 1). These sales involve CRADA-developed technology that is being procured by DoD and that has transitioned to DoD operational use. This high percentage is a positive finding, demonstrating the value of CRADAs to the U.S. defense mission.

Table 2. Sales by company size resulting from established by the CCDC Aviation and Missile Center, NSWC Crane, and the 711 HPW, 1996-2018

Company Size	CRADAs with Sales	Percent of Total CRADAs	Total Direct Impact \$ Millions	U.S. Military Sales \$ Millions
Large 500+ Employees	90	54%	\$7,923	\$4,592
Medium 100-499 Employees	13	8%	\$180	\$37
Small 10-99 Employees	38	23%	\$299	\$62
Very Small 1-9 Employees	27	16%	\$292	\$191
TOTAL	168	100%	\$8,694	\$4,882

Source: TechLink survey, February-July 2019

Note: Totals may not tally due to rounding



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Sales by Company Size. A notable survey finding was that large businesses (with 500 or more employees), which comprised around half (54 percent) of the companies reporting sales, accounted for approximately 91 percent of the total sales and 94 percent of the sales to the U.S. military (*see* Table 2). By contrast, small businesses, which represented slightly less than half of the non-DoD CRADA partners, accounted for only around 9 percent of the total sales and just 6 percent of the military sales.⁸

Other Economic Outcomes

In addition to sales, the companies in the study reported other significant economic outcomes. Companies received *total outside investment funding* (including venture capital and angel funding) directly attributable to the CRADA-developed technologies of slightly over \$75 million. In addition, seven companies reported that they were *acquired* primarily because of the technologies developed under these CRADAs. Companies reported that they had *licensed* 13 CRADA-developed technologies to other companies for commercialization. Finally, companies reported that they had *created* a total of 9 companies specifically to undertake the CRADA R&D or to commercialize the resulting CRADA-developed technologies. These other economic outcomes and impacts are summarized below:

- **Total outside investment funding:** **\$75,200,000**
- **Number of companies that were acquired:** **7**
- **Number of technologies licensed to other companies:** **13**
- **Number of new companies created:** **9**

⁸ “Small businesses” are considered to be those with fewer than 500 employees, using the U.S. Small Business Administration definition.



ECONOMIC IMPACT ANALYSIS

Upon receiving the anonymized company data from TechLink, the BRD at the University of Colorado Boulder employed the IMPLAN model to estimate the economic contributions of the total sales. Results below are presented for *output*, *value added*, *employment*, *labor income*, and *tax revenues*. As previously noted, all dollar figures are reported in 2019 dollars.

Total Economic Impact (Output): \$23.27 Billion

Output represents the **total economic impact** and is the total value of purchases by intermediate and final consumers—the sum of direct, indirect, and induced sales.⁹ Output is closely associated with economic impact analysis and is one of the values most frequently cited by economic impact studies. According to the national IMPLAN model, the \$8.69 billion in company-reported sales of new CRADA-developed products or services generated an additional \$14.58 billion in sales economy-wide. Of this, \$5.56 billion was the indirect effect, the result of inter-industry purchases, and \$9.01 billion was the induced effect, or increased household spending economy-wide (*see* Table 3). The total economy-wide output was \$23.27 billion.

Dividing total economy-wide output (\$23.27 billion) by the direct sales of products and services resulting from partnership agreements with DoD (\$8.69 billion) yielded an output multiplier of 2.68. That is, for every dollar in sales directly attributable to the DoD CRADAs, an *additional* \$1.68 in sales was generated economy-wide.

Value Added: \$13.35 Billion

Value added is the difference between industry or company output and the cost of intermediate inputs. Expressed differently, it is the difference between a product's sale price and its production cost (excluding labor). This measure recognizes that companies buy goods and services from other companies and create products of greater value than the sum of the goods and services used to make these products. This increase in value resulting from the production process is the "value added." As estimated by IMPLAN, value added is equal to the total sales (plus or minus inventory adjustments) minus the cost of the goods and services purchased to produce the products sold.

According to the national IMPLAN model, the \$8.69 billion in company-reported sales added \$13.35 billion to the national economy. Of this, \$5.07 billion was generated by direct

⁹ Technically, it is the total value of purchases, plus or minus inventory adjustments.



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sales, \$3.19 billion came from indirect sales, and \$5.09 billion resulted from the induced effect (see Table 3).

Employment: 118,929 Jobs (6,607 annually)

According to the national IMPLAN model, the sales resulting from the DoD CRADAs and their ripple effects economy-wide supported approximately 118,929 jobs. This includes 35,623 jobs through the direct effect (the sales of new products and services reported by the companies in the study), 29,584 from the indirect effect, and 53,721 from the induced effect (see Table 3). In these estimations, each job is defined as one job supported over one year. This means that, on average, 6,607 jobs were supported annually between 2000 and 2018.¹⁰

Labor Income: \$8.95 Billion

Labor income consists of employee compensation (wage and salary payments, including benefits), and proprietor income (income received by self-employed individuals). The national IMPLAN model estimated that labor income directly generated from the \$8.69 billion in sales was \$3.97 billion, or approximately \$111,320 per job (see Table 3).

The indirect labor income was estimated at \$2.10 billion, or approximately \$70,882 per job. The induced labor income was estimated to be \$2.89 billion, resulting in compensation of \$53,829 per job. Average compensation for indirect and induced jobs was substantially lower than for direct jobs because many were in lower-paid manufacturing and service sectors.

The total economy-wide labor income resulting from the DoD CRADAs was \$8.95 billion. The **average compensation** from the 118,929 jobs supported through these CRADAs was \$75,292. This compares with 2019 median national earnings of \$47,216.¹¹ The labor income multiplier was 2.26, indicating that for every dollar in wage and salary income attributable to DoD technology partnership agreements, an *additional* \$1.26 was generated nationally in employee compensation and proprietor income.

¹⁰ The oldest CRADAs in the study, from the CCDC Aviation & Missile Center, date back to 1996, while the oldest CRADAs from the 711 HPW date back to 2000 and those from the NSWC Crane to 2003. The 2000-2018 span for calculation of the average jobs per year figure assumes that the oldest CRADAs would not have generated any significant commercial results before 2000—a safe assumption given that CRADAs frequently last three years.

¹¹ Median national earnings were calculated using the median weekly earnings for the second quarter of 2019, from the Bureau of Labor Statistics (BLS). The average compensation (labor income per job) figures include the earnings of both employees and proprietors, through both work and business profits. Weekly earnings provided by the BLS do not include proprietor income, but are provided here as a general comparison.



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Tax Revenues: \$2.96 Billion

Tax revenues were estimated for the \$8.69 billion in sales and their economy-wide indirect and induced effects. These tax revenues included social insurance taxes such as Social Security and Medicare (paid by employers, employees, and the self-employed), personal income taxes, motor vehicle licenses, property taxes, corporate profits taxes and dividends, and indirect business taxes, consisting mainly of excise and property taxes, fees, licenses, and sales taxes. Total taxes collected by federal, state, and local government entities were estimated at \$2.96 billion (*see* Table 3). This included \$1.95 billion in total federal taxes, and \$1.01 billion in total state and local tax revenues. In sum, for every dollar of direct sales generated through the CRADAs, \$0.34 was collected in taxes by federal, state, and local governments.

SUMMARY

In summary, this study quantifies the contributions to the nation's economy and defense mission made by CRADAs established during the 1996-2018 period by three representative DoD labs—the Army's CCDC Aviation & Missile Research Center, the Navy's NSWC Crane, and the Air Force's 711 HPW.

The study team conducted a rigorous survey of companies to determine the total sales of new products and services resulting from these CRADAs. Companies in the study collectively attributed nearly \$8.7 billion in sales to these agreements. The team estimated the economic ripple effects of these sales using the IMPLAN model. These estimates define the indirect and induced effects of these sales on the national economy in terms of total economic output, value added, employment, labor income, and tax revenue.

The total economy-wide output was estimated at \$23.27 billion. Value added was estimated at \$13.35 billion, representing new wealth creation in the economy. Employment impacts included 118,929 jobs with average compensation of \$75,292, approximately 45 percent higher than the median U.S. wage in 2019. Total labor income was estimated at \$8.95 billion. The \$8.69 billion in sales and its economy-wide effects generated approximately \$2.96 billion in total tax revenue, including \$1.01 billion in federal tax revenues and \$1.95 billion in state and local tax revenues.

Table 3 summarizes the national economic impacts resulting from CRADAs established by the CCDC Aviation & Missile Center, NSWC Crane, and 711 HPW during the 1996 to 2018 period. Appendix 1 summarizes the contributions of each of these three labs to the overall impacts.

Table 3. Nationwide economic contribution resulting from CRADAs established by the CCDC Aviation & Missile Center, NSWC Crane, and 711 HPW, 1996-2018

	Output \$ Billions	Employment Jobs Supported	Value Added	Labor Income \$ Billions	Average Compensation¹²	Tax Revenue \$ Billions
Direct Impact	\$8.69	35,623	\$5.07	\$3.97	\$111,320	--
Indirect Impact	\$5.56	29,584	\$3.19	\$2.10	\$70,882	--
Induced Impact	\$9.01	53,721	\$5.09	\$2.89	\$53,829	--
Federal Tax Revenues	--	--	--	--	--	\$1.01
State and Local Tax Revenues	--	--	--	--	--	\$1.95
TOTAL NATIONAL ECONOMIC IMPACT	\$23.27	118,929	\$13.35	\$8.95	\$75,292	\$2.96

Sources: BRD, IMPLAN

Notes: Totals may not tally due to rounding. All dollar figures in 2019 dollars.

¹²Average Compensation is a measure of Labor Income per Job



APPENDIX 1

National Economic Impacts by DoD Laboratory

The following tables provide a more detailed look at the economic impacts resulting from the DoD CRADAs in this pilot study. These tables summarize the estimated economic impacts from CRADAs at each of the three DoD labs participating in this study: the CCDC Aviation & Missile Center (237 CRADAs), NSWC Crane (207 CRADAs), and the 711 HPW (201 CRADAs). For explanations of the economic terms used in the appendices, please refer to the main text of the report.

Tables

- 1. U.S. Army CCDC Aviation & Missile Center**
- 2. Naval Surface Warfare Center Crane Division**
- 3. Air Force Research Laboratory 711th Human Performance Wing**

Table 1. U.S. Army CCDC Aviation & Missile Center

Impact Type	Output \$ Billions	Value Added \$ Billions	Employment Jobs Supported	Labor Income \$ Billions	Average Compensation
Direct Impact	5.048	2.726	19,076	2.054	\$107,700
Indirect Impact	3.669	1.997	16,904	1.314	\$77,727
Induced Impact	5.014	2.833	29,877	1.608	\$53,833
TOTAL ECONOMY- WIDE IMPACT	13.730	7.556	65,857	4.977	\$75,569

Table 2. Naval Surface Warfare Center Crane Division

Impact Type	Output \$ Billions	Value Added \$ Billions	Employment Jobs Supported	Labor Income \$ Billions	Average Compensation
Direct Impact	2.790	1.879	13,486	1.574	\$116,746
Indirect Impact	1.350	0.873	9,683	0.578	\$59,663
Induced Impact	3.196	1.805	19,046	1.025	\$53,824
TOTAL ECONOMY- WIDE IMPACT	7.336	4.557	42,216	3.177	\$75,265

Table 3. Air Force Research Laboratory 711th Human Performance Wing

Impact Type	Output \$ Billions	Value Added \$ Billions	Employment Jobs Supported	Labor Income \$ Billions	Average Compensation
Direct Impact	0.856	0.462	3,061	0.337	\$109,976
Indirect Impact	0.543	0.319	2,997	0.205	\$68,516
Induced Impact	0.805	0.455	4,799	0.258	\$53,825
TOTAL ECONOMY- WIDE IMPACT	2.204	1.236	10,857	0.800	\$73,712